

June 2, 1930.

Mr. James W. Bishop,  
Office, Mr. Henry Ford,  
Dearborn, Mich.

Dear Mr. Bishop;

In answer to your letter of May 27th relating to Mr. Ford's Edison "Z" dynamo No. 13, I have been interested in the photo of it, and in reading accompanying extract from a letter to you from Mr. Wardlaw about the machine, had copy of your reply.

There were some errors by Mr. Wardlaw, such as we all are apt to make when going back nearly fifty years, but you straightened that out.

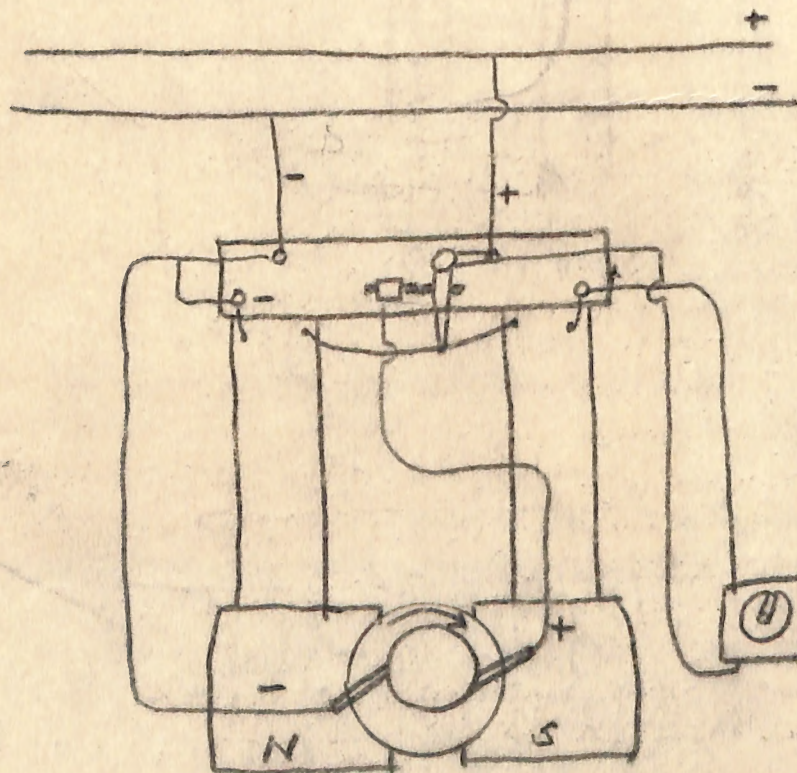
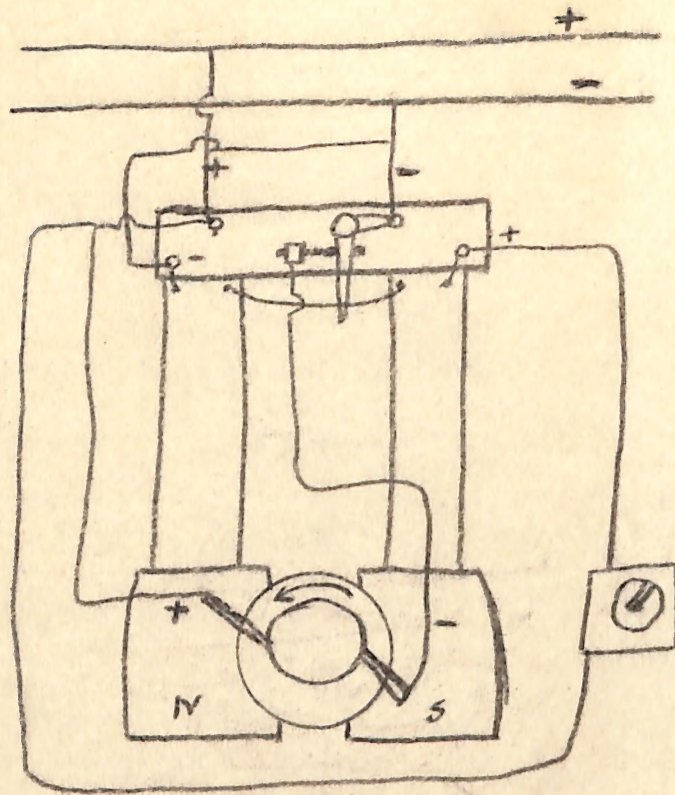
In operation by customers these machines were, I believe, run counter-clockwise, when there was only one driven by an Armington & Sims engine. But I have layout sketches, or outline drawings, which show, when two dynamos were run from one engine, that sometimes they ran in opposite directions and sometimes in the same direction.

There was no set rule about direction of rotation. I enclose herewith free-hand copies of saved blueprints of all connections for armature rotation in either direction, which belong to the year 1882.

No doubt this No. 13 machine has been altered, amended, etc. more or less in its long life. At present the armature circuit switch can perform no useful function. My notion is that the left-hand switch-block was connected with the brush lead by a washer-shaped end on the lead and under the block, as found in other Edison dynamos when a plug switch was used; of this you have examples in other early Edison dynamos, and some book illustration will probably show it on a "Z". Mr. Wardlaw's description about wiring details will be useful. Please let me know how I can further assist in this matter.

Sincerely yours, Chas. F. Clarke.





Edison "Z" dynamo. Connections  
for running clockwise and  
counter-clockwise, 6/2/30.  
R. F. Clarke.



By Wilmington & Sons engineers:

A. & S.  
2 "Z" dynamos - single engine.  
belts were back past engine  
to dynamos. Looking from  
commutator end of shaft  
toward the armature, one  
~~the~~ armature ran clockwise  
and the other counter-clock-  
wise - the armature shafts  
were in line, and both  
commutators were outboard  
and both pulleys inboard.  
Engine over running

Engine  
over  
running 1 "K" dynamo only - driven by  
A. & S. engine - ~~both~~ armature  
ran counter-clockwise. <sup>Forward</sup> belted.

Engine  
over  
running 1 "L" dynamo only - driven by  
A. & S. engine - armature ran  
counter-clockwise. Forward belted.

Engine  
over  
running 1 "K" dynamo only - single engine  
A. & S. Back belted. armature  
counter-clockwise.

Engine  
over  
running 2 "Z" dynamos - single A. & S. engine.  
Forward belted - both pulleys inboard,  
- one armature clock-wise, the  
other counter-clock-wise

2 "Z" dynamo, staggered, A. & S. engine,  
back belted, but under-running.  
Both armatures counter-clockwise. ~~both~~  
both pulleys on same side of dynamos.

2 "Z" dynamo, shafts in line, both pulleys  
inboard, ~~one~~ one armature clockwise  
other counter-clockwise. Forward belted



From my 1882 blueprints  
of Edison dynamo, as driven  
by Worthington & Sime engine:

<sup>A. & S.</sup>  
2 "Z" dynamo - single engine.  
belts were back past engine  
to dynamos, looking from  
commutator end of shaft  
toward the armature, one  
~~the~~ armature ran clockwise  
and the other counter-clock-  
wise - the armature shafts  
were in line, and both  
commutators were outboard  
and both pulleys inboard,  
<sup>Engine over running</sup>

<sup>Engine over running</sup> 1 "K" dynamo only - driven by  
A. & S. engine - ~~both~~ armatures  
ran counter-clockwise. <sup>Forward</sup> belted.

<sup>Engine over running</sup> 1 "L" dynamo only - driven by  
A. & S. engine - armatures ran  
counter-clockwise. <sup>Forward</sup> belted.

<sup>Engine over running</sup> 1 "K" dynamo only - single engine  
A. & S. Back belted. armatures  
counter-clockwise.

<sup>Engine over running</sup> 2 "Z" dynamo - single A. & S. engine.  
Forward belted - both pulleys inboard,  
- one armature clock-wise, the  
other counter-clock-wise

2 "Z" dynamo, staggered, A. & S. engine,  
back belted, but under running.  
Both armatures counter-clockwise. <sup>both</sup> pulleys on same side of dynamo.

2 "Z" dynamo, shafts in line, both pulleys  
inboard, ~~one~~ one armature clockwise,  
other counter-clockwise. Forward belted.



2 "2" dynamos, shafts in line,  
both pulleys inboard, A. & S.  
overrunning engine - back belted,  
one armature clockwise, other  
counter-clockwise

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*Henry Ford*  
*Dearborn, Mich.*

May  
27th  
1930

Mr Charles L Clarke:  
c/o Research Laboratories  
General Electric Co  
Schenectady N Y

Dear Mr Clarke:

I am enclosing herewith a portion of a letter received from Mr F A Wardlaw with reference to an old Z dynamo which we now have in Dearborn. I sent a photograph of this dynamo to you sometime ago so that you may refer to it on reading the enclosed letter. According to Mr Wardlaw some of connections are not as they were originally and, as you know, it is our utmost desire to have these machines in their original condition without any apologies if such a thing is possible.

We would greatly appreciate your comments on Mr Wardlaw's criticism as we are inclined to think that about the only chance for information at the present time regarding the above machines would be you and Mr Wardlaw.

We wish to start sometime soon to put some of our old Edison dynamos in 100% condition but cannot do that without the proper information which would enable us to reproduce them correctly.

Any information you can give us on the above subject will be greatly appreciated.

Yours very truly

JAS W BISHOP  
*Jas. W. Bishop*  
Office of HENRY FORD

JWB MJ



May  
27th  
1930

Mr F A Wardlaw  
c/o Edison Pioneers  
40 W 40th St  
New York City

Dear Mr Wardlaw:

We wish to acknowledge with many thanks receipt of yours of April 21st which, owing to my absence from the city, has just come to my attention. While I was away only a little over a week, a vast amount of mail came in the meantime and I am just beginning to get to the bottom of it. Your letter referred to the old Edison bipolar dynamo with serial No. 13.

We greatly appreciate your comments on this machine which is the very reason we sent the pictures and information on to you, knowing that if everything was not 100% correct, that you would be able to detect anything that might be wrong.

You spoke of the direction of rotation being altered owing to circumstances which governed the change. I have examined the picture and also looked at the machine and I find that the way the brushes and brushholders are mounted that the machine did operate in a counter-clockwise direction. I think that if you will take another look at your picture that you will agree with me that it is counter-clockwise rotation facing the commutator. A positive lead from the left hand brush now goes to the heavy binding post on the left of the headboard, which is correct according to your description. You say that the negative wire led to the lower left hand switch casting which made the switch open the circuit of this machine on the negative lead. This is undoubtedly correct but I can find no place on the lower stationary contact of the switch

where any wire could be fastened into it. So I have every reason to believe that this stationary contact is not as it was originally designed.



# Z dynamo, June, 1883

Magnet wire #17 B.W.G. - 0.058".

6 1/2 layers - 550 turns per layer.

Resistance of each core 20 ohms.

Total (2 cores) 40 " .

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Armature resistance 0.145 ohms  
at 60° F.

0.17 "

at 160° F.

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"A" lamps - 103 ohms (hot) - 95 volts.

Absolute E.M.F. of entire circuit  
104.7 volts.

Current of total circuit 56.9 amps.

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Columbia dynamo. "A" machine

Core 220 turns per layer

to 210

#10 B.W.G. 13 1/4 mils.

Each magnet coil. 7197 ohms



Mr F A Wardlaw #2

May 27th 1930

I find that the field connection to the brush lead was not connected as shown on the right hand leg of photo. This wire is merely hanging down and is not connected to anything but the photo is misleading and you would naturally think that it was connected to the right hand brush lead. The two field leads do go to the small binding post but we do not know which way they made the field connections from there as the machine is now just as it was when it arrived. We have made no changes whatever in any connections of any kind.

We would be very glad indeed if you would give us a pencil sketch of just how the connections should be on this machine so that there will be no criticism from anybody after the machine is placed on exhibition.

I am sending a copy of that part of your letter pertaining to this machine to Mr Charles L Clarke together with a copy of this letter so that between the two of you we should be able to get the facts pertaining to the proper connections on this old machine.

We wish to again thank you for your criticism of this machine as it is only in this manner that we can get all the facts in the case and restore them as they were originally which, as you know, is our utmost desire. Your cooperation is very much appreciated.

Very truly yours

JAS W BISHOP

Office of HENRY FORD

JWB MJ

CC: Mr Charles L Clark  
c/o Research Laboratories  
General Electric Co  
Schenectady N Y



The Edison Institute of Technology  
Dearborn, Michigan

March  
5  
1931

Mr Charles L Clarke  
C/o General Electric Co  
Schenectady N Y

Dear Mr Clarke:

I was just looking over some old correspondence I had with you last June relative to an old Type "Z" dynamo with serial No. 13 which we obtained from the Harding-Jones Paper Company at Excello, Ohio.

I find that no acknowledgment was sent to you of your letters of June 2 and June 3 which was very negligent of me and I offer my apologies for not having done so.

Attached to the letter of June 2 were two sketches showing connections for the type "Z" machine to operate in clockwise and counterclockwise rotation. Both of these diagrams show that when the switch on the head-board of the machine is in the open position, the field circuit is also open. In other words, the field is left connected on the load side of the machine rather than on the armature side so that when the switch is closed it builds up the field as well as its load at the same time, and I was wondering if this is the way they intended the machines to be connected. It would seem to me that they would want the switch between the dynamo and the load, leaving the field connected across the armature at all times. We may start to fix up this old machine almost any time and I wanted you to set me right on the connections of these machines before we made a mistake. If the machine should be connected as per your sketch, we certainly will connect them that way, but it looks to us as if the field should be connected across the armature to enable the machine to build up the voltage before closing the switch on the head-board of the machine in order to pick up a load.

We will, however, be governed entirely by your decision in this matter.

Yours very truly

JAS W BISHOP

*Jas. W. Bishop*  
EDISON INSTITUTE



1431 Rugby Road,  
Schenectady, N.Y.,  
March 14, 1931.

Mr. Jas. W. Bishop,  
Office, Henry Ford,  
Dearborn, Mich.

Dear Mr. Bishop:

Your letter of the 5th, concerning data in mine of last June 2nd and 3rd, relating to Edison's way of connecting up a "Z" dynamo, was duly received. One thing and another have made my reply thereto rather slow—but never mind—guess I won't apologize this time; perhaps next time.

The diagrams from my blueprints of 1882, copies in my letter of June 2nd, show, as you say March 5th, that opening the switch of a machine also opens the field circuit, when there is but one machine in the installation, however, as indicated in above diagrams. And this is the way Edison did it—the Armington & Sims engine, the dynamo, the field and C.P. of lamps often built up operation together—or after speed was up, the switch was closed with resistance box all in, and then lamps were brought up to C.P. by throwing out field resistance gradually. The "Z" machine on page 269, Electric Illumination, by Dredge, Vol. 1, Aug. 1882, is connected up the same way. But the story is different when two or more machines are in the installation, as shown in copies, herewith, of 1882 blueprints of connections for <sup>two</sup> machines with armatures rotating in the same and opposite directions, respectively. When the switch of one machine is opened, its field is still energized by current from the other machine. Thus for isolated plants of several machines, as in mills, armatures could be easily thrown in and out for load change, belt bearing, bad commutator, etc., with no risk of an armature on the line with no field, thus no heavy short circuit. By the way! the diagrams equally apply to "L" and "K" machines.

Very truly yours,  
Chas. F. Clarke.



E. J. Blount  
 3/14/31  
 dynamo connections of 1882.  
 Edison "Z", "L", "K"

